

California Space Grant Consortium
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The California Space Grant Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2012.

PROGRAM GOALS

California Space Grant Consortium (CaSGC) Goals and SMART Objectives are as follows:

1. Promote diversity and inclusion in all programs and activities by encouraging participation by underrepresented minority and female students and faculty.
 - Objective 1A: Each academic year, provide a percentage of awards to underrepresented minority and female students that is consistent with diversity targets established by NASA. The diversity targets are currently 39% for awards to minority students, based on National Center for Education Statistics data for California (2009), and 40% for awards to female students, based on NASA guidance.
 - Objective 1B: Undertake at least three collaborative programs with a non-member minority serving institution each year.
 - Objective 1C: Each academic year, conduct at least one outreach event in partnership with a non-member minority serving institution to promote programs and opportunities to students and faculty.
2. Conduct quality scholarship and fellowship programs including Science, Technology, Engineering, and Math (STEM) research awards for community college, undergraduate and graduate students to broaden and deepen students' knowledge and prepare them for advanced STEM degrees or STEM employment.

- Objective 2A: Each academic year, award undergraduate, graduate, and community college students with scholarships and fellowships. Students will be competitively selected by a review panel.
 - Objective 2B: Award at least the minimum funding amount required by NASA (currently \$150,000 from baseline and \$55,000 from augmentation funds) to at least 75 students each academic year.
 - Objective 2C: Each academic year, provide a percentage of fellowship/scholarship awards consistent with Objective 1A.
 - Objective 2D: Longitudinally track 100% of all students receiving significant awards to identify their next step in academia or the workforce. Significant awards are those equal to or greater than \$5,000 or 160 contact hours, cumulatively.
 - Objective 2E: At least 90% of students completing their education and receiving significant awards will be employed by NASA, an aerospace contractor, higher education or other educational institutions.
 - Objective 2F: At least 50% of undergraduate students receiving significant support from CaSGC will move on to advanced education in NASA-related disciplines.
3. Undertake programs that foster research capabilities at our affiliate institutions and serve as a catalyst for linking university researchers to NASA and other opportunities.
- Objective 3A: Each academic year, support at least three interdisciplinary student research infrastructure projects in partnership with CaSGC affiliate institutions.
 - Objective 3B: Each academic year, involve at least 15 students in research infrastructure projects in partnership with CaSGC affiliate institutions.
 - Objective 3C: Each academic year, provide a percentage of research infrastructure awards consistent with Objective 1A.
4. Offer quality interdisciplinary hands-on higher education programs in partnership with our affiliate institutions to prepare students for STEM employment.
- Objective 4A: Each academic year, provide paid internships for at least six students at California NASA Centers and at least one student at an industry partner.
 - Objective 4B: Each academic year, conduct at least five hands-on interdisciplinary higher education projects in partnership with CaSGC affiliate institutions.
 - Objective 4C: Each academic year, involve at least 75 students in hands-on interdisciplinary higher education projects in partnership with CaSGC affiliate institutions.
 - Objective 4D: Each academic year, hands-on higher education projects will involve students at a level consistent with Objective 1A.
 - Objective 4E: Each academic year, at least 70% of Minority Serving Institution (MSI) affiliates will be involved in our higher education programs. Currently there are 7 MSI affiliates.
 - Objective 4F: Each academic year, at least two new or revised courses targeted at the STEM skills needed by NASA will be developed with CaSGC support.

5. Provide quality precollege educational opportunities including professional development for pre-service and in-service educators and student-focused programs for students throughout the precollege pipeline.

- Objective 5A: Each year, provide professional development in STEM using NASA resources to at least 40 teachers.
- Objective 5B: Each year, reach over 200 precollege students by conducting student-focused programs and activities promoting participation in STEM and related careers.
- Objective 5C: At least 75% of precollege educators participating in two or more days of professional development will use NASA resources in their classroom following the workshop.
- Objective 5D: At least 60% of precollege educators receiving NASA resources or participating in CaSGC-led short duration activities will use NASA resources in their classroom.
- Objective 5E: At least 50% of all precollege students participating in CaSGC-sponsored programs will express an interest in STEM careers.

6. Conduct Informal Science Education programs in partnership with formal and informal education members and partners.

- Objective 6A: Each academic year, utilize material developed in CaSGC's other program elements to inspire and engage the general public at science-related events and university open houses.
- Objective 6B: Sponsor at least one program each year with the Reuben H. Fleet Space Theater, the San Diego Air & Space Museum, and/or the California Science Center.
- Objective 6C: Consider other appropriate informal science education opportunities as funding and partnerships permit with the goal of at least one other activity per year.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, & 3)

Outcome 1 Highlight: San Diego MESA Alliance Summer Research Academy "What is Research"

We piloted a program with our MSI (Minority Serving Institution) affiliate San Diego State University and two MSI community colleges entitled "MESA Research Academy: A Train-the-Trainer Academy for Understanding 'What Is Research?'"

The goal was to expose underrepresented community college students to engineering research and hands-on experiences in STEM.

Twenty community college students shadowed five graduate students in five research projects: 1. High Altitude Ballooning, 2. Aircraft Wing Structural Dynamics, 3. Mixing and Flow Control in High Speed Combustors, 4. Sensorimotor Prosthetic Hand (Robotics), and 5. Dynamics of Flame Spread in Microgravity.

This was the first time many of these community college students had conducted laboratory research. Pre and post-project surveys show an increase in skills and

knowledge of Literature Surveys, The Scientific Method, Teamwork, Time Management, Presentation Skills, Experimental Analysis, and Design & Manufacturing. One student commented: “The research academy has been one of the most influential turning points in my life...I had no prior knowledge as to what opportunities were out there in terms of research. This experience has provided me with a new found objective towards pursuing a Ph.D. to conduct my own research and follow a path that would allow me to contribute to my field of interest.”

To further increase the impact of this experience, the students prepared presentations on their work and presented to hundreds of students at their community colleges as well as K-12 students in the MESA Schools Program. (MESA: Mathematics, Engineering, Science Achievement—a program for educationally disadvantaged students).

Outcome 1 Highlight: Student Accomplishment—Javier Gonzales-Rocha

Javier Gonzales-Rocha, a Hispanic Mechanical Engineering student and first in his family to go to college, was supported by the California Space Grant Consortium since he was an undergraduate. During his undergraduate experience at California State University, Sacramento, he was mentored by our affiliate campus director in an International Space Station 3D Model and Finite Element Analysis project. He completed his B.S. degree as well as an M.S. program at the same institution. During this time, he was identified by the California Space Grant Consortium for participation in the Aeronautics Academy at NASA Dryden Flight Research Center where he worked on the Primary Research Aerodynamic Design to Lower Drag (PRANDLT-D) project. This was a pivotal career experience for Javier and he has recently accepted a full fellowship to pursue a Ph.D. degree at Virginia Tech in the Department of Aerospace and Ocean Engineering. Later this year Javier will present a paper on his research at the 2013 ASME Dynamic Systems and Control Conference. Throughout his academic career Javier has been a student leader, involved in diversity programs and outreach.

Comment from Javier: “The support that I have received from the California Space Grant has been pivotal towards being admitted into this very competitive graduate program and securing full funding commitment.”

Outcome 2 Highlight: California State University Long Beach precollege programs

We provided NASA aerospace content and professional development to 20 K-12 in-service educators through two programs: “My Daughter is an Engineer” and “Engineering Girls—It Takes A Village”, offered through our MSI (Minority Serving Institution) affiliate California State University, Long Beach. While these programs were specifically designed to serve rising middle school girls from underrepresented backgrounds, in-service K-12 educators supported by the California Space Grant Consortium have participated to gain an understanding of the importance of early career awareness and how best to engage students’ interest in engineering during the formative school years.

Activities during the three-day residential camp included engineering-based workshops on robotics and control technologies in everyday life, academic career preparation and skills learning, and an engineering-relevant field-trip to the Columbia Memorial Space Center. K-12 educators worked alongside parent-daughter pairs and attended additional project-based workshops focused on aerospace engineering concepts related to NASA's Mission Directorates. The over-riding goal of in-service teacher participation was to help K-12 educators weave NASA-related aerospace engineering content into existing K-12 curriculum.

PROGRAM ACCOMPLISHMENTS

Outcome 1: *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals:*

The CaSGC ran 38 Fellowship/Scholarship, Research Infrastructure, and Higher Education projects at 14 of our affiliate campuses and 7 non-affiliate MSI community college campuses to provide mentored-research and hands-on interdisciplinary group projects preparing students for the needs and challenges of the STEM workforce. Through these projects the CaSGC issued 193 awards, of which 72 (37.3%) were to underrepresented minority students and 76 (39.4%) were to females. These almost meet the targets in SMART Objective 1A (39% for underrepresented minorities and 40% for women) and meet Objective 1B for at least three collaborative programs with non-member minority serving institutions. (All SMART Objectives are listed starting on Page 1).

Fellowship/Scholarship awards this year were to 68 students, competitively selected. These awards totaled over \$150,000. Of these 68 scholarships, 25 (37%) are to underrepresented minorities and 37 (54%) are to females. These directly relate to SMART Objectives 2A, 2B, and 2C which were met (2A and 2B), exceeded (2C goal for women at 40%), or just a few percentage points below (2C for underrepresented minorities at 39%). Criteria for student selection included academic achievement, letters of recommendation, leadership, and personal statements. Projects include graduate student research in Geophysics, Space Physics, and Aerospace Engineering and undergraduate student research in Chemical Engineering, Nanotechnology, Materials Science, Biology (related to tissue generation using stem cells in space), Photovoltaics (adaptive and intelligent forecasting for solar power), Remote Sensing, Earth System Science, and Astronautics (CubeSat and Lunar Lander projects). Also included are scholarships for 6 students to attend NASA Academy or NASA Internships in the summer at a California NASA center (SMART Objective 4A) as well as 10 Undergraduate Research Opportunity Program scholarships for students to conduct mentored-research of their own choosing in an area that addresses priorities of one of the NASA Mission Directorates.

Research Infrastructure awards this year were to 15 graduate and undergraduate students in six projects. Of the students awarded, 2 (13%) are underrepresented minorities and 3 (20%) are female. We meet Objective 3A and 3B in terms of the numbers of projects and

students but do not meet Objective 3C in our targets of underrepresented and female students for this particular program element (although we are almost at target for all three higher education program elements combined). In FY2013 we will take action to provide more Research Infrastructure opportunities to students traditionally underrepresented in STEM. This year's projects include Synthetic Biology (understanding if there could be life in the clouds above Venus; mining for metals on other planets and asteroids), High Endurance Green Aircraft Design (using advances in solar cell efficiency, aircraft design, and lightweight composite materials), Aerospace research in the Control of Mixing in High-Speed Combustors, Research Collaborations in Environmental Science (Hyperspectral Infrared Imager) to study the world's ecosystems and provide critical information on natural disasters, and Research Collaborations between astrophysics, digital arts, and computational sciences bringing sophisticated visualization tools to the science community.

Higher Education awards were to 110 students in 24 projects at 12 of our affiliates, including 5 Minority Serving Institution affiliates (addresses Objective 4E) as well as 6 non-affiliate Minority Serving Institution community colleges. Of the students awarded 45 (41%) are underrepresented minorities and 36 (33%) are female. (Addresses Objectives 4B, 4C, and 4D in terms of underrepresented minorities; with regard to females, we are continuing to make strides in increasing this number through our partnership with a local chapter of the Society of Women Engineers). Interdisciplinary Higher Education projects include student run mentoring workshops to train Engineering students in the practical use of electronics for engineering projects, student-led flight projects involving Near Space Balloons where students form Systems Engineering teams to send experiments and instrumentation into Near Space and safely bring them back to earth, and a robotics team studying how to use Dynamic Tensegrity for robots performing space missions. Additional projects involve rockets, supporting two teams in the NASA University Student Launch Initiative competition in April 2013, as well as a senior design project where students analyzed, designed, built, and flew a 1000 pound thrust liquid fueled (LOX/biofuel) rocket in a design, build, and fly cycle of only 10 weeks. Our Higher Education projects also include an outreach project to introduce students and faculty at a non-affiliate Minority Serving Institution to our programs. This project involved distance learning seminars from university students and industry engineers for the MSI community college students as well as a hands-on Arduino microcontroller project in which the community college students worked in teams to develop modules for biosensors (project addresses Objective 1C for outreach to minority serving institutions).

In our Higher Education projects, CaSGC student teams worked on the design and construction of a portion of the backing structure for a morphable mirror telescope to observe Cosmic Microwave Background radiation, worked on an asteroid mitigation design project using phased arrays of lasers to vaporize asteroids by the power of the sun, and launched the "AENEAS" CubeSat on an Atlas V from Vandenberg Air Force Base in September 2012. In addition, the CaSGC conducted a Research Academy for MSI community college students to give them university laboratory experience introducing them to research and provided a professional development program with another MSI

community college that included workshops, a design project, and expert consultation to put new teaching skills into practice in “teaching labs” for undergraduate STEM students.

Within the Higher Education program element, the CaSGC launched six new and six revised courses related to STEM skills needed by NASA (exceeds Objective 4F). New courses include a Satellite Operations Course for undergraduates teaching students how to track and process telemetry from a real NASA satellite, a course on Signals, Systems & Data Acquisition, a Remote Sensing Certificate Program, an undergraduate Astronomy course on Dead Stars & Black Holes, a graduate Astronomy course on Visualization, and a Computational workshop for MSI community college students.

For the above-described Outcome 1 higher education program elements (Fellowship/Scholarship, Research Infrastructure, and Higher Education), the CaSGC provided students with the knowledge, skills and interdisciplinary team experience for development of the STEM workforce in disciplines needed to achieve NASA’s strategic goals.

Outcome 2: *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty:*

For the Precollege program element, the CaSGC conducted nine programs involving Precollege students, pre-service teachers, and in-service teachers to engage and educate the students in STEM disciplines. A total of 296 Precollege students, 34 pre-service educators, and 56 in-service educators participated in our programs this year (addressing Objectives 5A and 5B). Projects were a progression of educational opportunities beginning with short introductions to STEM disciplines, such as our distance learning project involving geology (Mars Science Lab measurements of soil on Mars in comparison with various soils found on Earth), physics (roller coaster data visualization using accelerometer data and a hands-on accelerometer project), and magnetism (in conjunction with an informal education provider). The CaSGC supported a STEM Explorers program where Precollege students in a homeless shelter participated in a series of evening presentations by NASA scientists and engineers focusing on space, exploration, earth sciences, technology, and computing, linking science and math at school to broader career choices. The CaSGC also provided week-long enrichment programs in engineering for middle school and high school students as well as a summer-long research intensive program for students to experience working in university laboratories. During the school year we provided a middle school with an opportunity to send a project to the International Space Station where astronauts carried out the students’ experiments. We also conducted a nine-month research program in environmental sciences where high school students from underserved backgrounds conducted research projects under graduate student mentors.

Continuing along this progression, we provided pre-service and in-service teacher training using NASA-based scientific content and inquiry methods targeting underserved audiences in astronomy workshops of short duration (1.5 hours and 4 hours) as well as longer duration (2 days). We also sponsored two week-long residential programs for in-

service teachers through the “My Daughter is an Engineer” and “Engineering Girls—It Takes a Village” programs where educators were recruited from underserved school districts for workshops with NASA-based content to incorporate into their existing K-12 math and science curriculum. Our affiliates are in the process of tracking precollege educators to determine what percentage apply NASA content from our programs into their classrooms (Objectives 5C and 5D). Pre and post project assessments of our precollege students show an increased interest in pursuing STEM careers after participation in our programs (Objective 5E).

Outcome 3: *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA’s mission:*

The purpose of the CaSGC Informal Education program is to inspire and engage the general public in STEM, promote STEM literacy and awareness of NASA’s mission, and expand the nation’s future STEM workforce. This year’s projects included the San Diego Science Festival, UC San Diego Triton Day, San Diego Air & Space Museum Space Day, UC Davis University Open House, and UC Los Angeles Astronomy Day. In these events we held a geospatial exhibition in conjunction with AmericaView showcasing educational materials to students, educators, and the general public, supported an open house for those interested in Space Science, Planetary Science and Astronomy, and exhibited a Near Space Balloon Project with hands-on demonstrations. We estimate having reached at least 3000 people in these activities. In this program element we strategically link our higher education students to science and engineering informal education events where students prepare demonstrations and exhibits related to their higher education projects (Objective 6A). In conjunction with the Reuben H. Fleet Science Center we held a distance learning magnets activity (with archived video available online) and will be hosting an “Amazing Space” Family Science Night for disadvantaged schools later this year (Objective 6B). We are also considering other appropriate informal science education opportunities as funding permits (Objective 6C).

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:** Number of program student participants employed by NASA, aerospace contractors, universities, and other educational institutions; Number of undergraduate students who move on to advanced education in NASA-related disciplines; Number of underrepresented and underserved students participating.

Total CaSGC awards in FY2012 = 193 of which 68 awards are in the Fellowship/Scholarship program element and 125 awards are in the Higher Education/Research Infrastructure program elements. Of this year's awardees:

- 72 (37.3%) are minority students underrepresented in STEM fields
 - 76 (39.4%) are female
 - 12 have graduated and are pursuing advanced STEM Degrees
 - 4 are employed in STEM Aerospace
 - 3 are employed in STEM Non-Aerospace
 - 1 is employed at NASA
 - 2 are employed in "Other" STEM Academic Fields
- **Minority-Serving Institution Collaborations:** Summarize interactions. Reference the names of projects with MSI collaborations.
This year the CaSGC collaborated with 14 Minority Serving Institutions, of which six are affiliates and eight are non-affiliates.:
 - California State Polytechnic University, Pomona (affiliate):
 - Cal Poly Pomona Aerospace Vehicle Laboratories STEM Pipeline Project:
 - Student-run mentoring workshop to train Engineering students in practical use of electronics for engineering projects.
 - High altitude balloon project
 - University Student Launch Initiative (USLI)
 - Senior design projects
 - California State University, Fresno (affiliate):
 - 2013 Summer Engineering Experience Camp: An enrichment program in engineering for middle school and high school students.
 - Aerospace Workforce Development: Supporting research and development in Unmanned Aerial Systems (UAS)
 - California State University, Long Beach (affiliate)
 - In-service teacher training with NASA aerospace content at two summer residential programs:
 - My Daughter is an Engineer
 - Engineering Girls—It Takes A Village
 - California State University, San Bernardino (affiliate):
 - STEM Workforce Development through Astronomy at an HSI
 - San Diego City College (affiliate through the San Diego Community College District):

- Research Academy introducing community college students to hands-on university research (with San Diego State University affiliate)
- San Diego State University (affiliate):
 - Research Academy introducing community college students to hands-on university research
 - Aerospace research in the Control of Mixing in High-Speed Combustors
- Cabrillo College (non-affiliate):
 - OPENLAB: Art and Space Science Program bringing sophisticated visualization tools to the science community (with UC Santa Cruz affiliate)
- Citrus College (non-affiliate)
 - High altitude balloon project (with Cal Poly Pomona), including outreach to middle schools and high schools to speak with students about engineering
- Hartnell College (non-affiliate):
 - OPENLAB: Art and Space Science Program bringing sophisticated visualization tools to the science community (with UC Santa Cruz affiliate)
- Los Angeles City College (non-affiliate):
 - Distance Learning Arduino Project: Microcontroller project in which the community college students worked in teams to develop modules for biosensors
- Mt. San Antonio College (non-affiliate):
 - STEM Workforce Development through Astronomy at an HSI (with CSU San Bernardino affiliate)
- Napa Valley College (non-affiliate):
 - Increasing the Flow through the STEM Pipeline at Sonoma State University (hands-on intensive summer research projects with Sonoma State University affiliate)
- Santa Barbara City College (non-affiliate):
 - Morphable Mirror Telescope (design and construction of a portion of the backing structure for a morphable mirror telescope to observe Cosmic Microwave Background radiation—with UC Santa Barbara affiliate)
- Southwestern College (non-affiliate):
 - Research Academy introducing community college students to hands-on university research (with San Diego State University affiliate)
- **NASA Education Priorities:**
 - *Authentic, hands-on student experiences in science and engineering disciplines – the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA-related, STEM-focused questions and issues; the incorporation of real-life problem-solving and needs as the context for activities—*The CaSGC conducted numerous NASA-related

hands-on, interdisciplinary experiences in science and engineering including, but not limited to: Student-led flight projects in near space ballooning, rockets, unmanned aerial vehicles, and CubeSats; interdisciplinary robotics teams; designing and building a lunar lander and the backing structure for a morphable mirror telescope.

- *Diversity of institutions, faculty, and student participants (gender, underrepresented, underserved)*—The CaSGC has made major strides in engaging more Minority Serving Institutions (MSIs) and students from underrepresented backgrounds in meaningful projects. We have reached out to MSI community colleges, partnered them with our four-year affiliate university campuses, and provided funding for projects that will give those community college students university research and team experience to bridge them from the community colleges to university STEM programs. Our efforts have included collaborations with STEM diversity organizations, including two scholarship programs with the Society of Women Engineers to address gender diversity in Engineering. We are also working with programs at our universities that serve students from educationally disadvantaged backgrounds. Our faculty include several from underrepresented backgrounds and we are working to increase their level of participation in our programs.
- *Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines (see above)*—The CaSGC has provided several programs for middle school teachers including astronomy workshops with NASA science content and inquiry-based methods reflecting approaches in the new Next Generation Science Standards (NGSS). We have also provided NASA aerospace-related content in workshops to middle school teachers through the “My Daughter Is An Engineer” and “Engineering Girls—It Takes A Village” programs.
- *Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers*—To increase enrollment in STEM the CaSGC runs week-long engineering summer enrichment programs on university campuses for middle school and high school students as well as a summer-long research intensive program for students to experience working in university laboratories. We also conducted a nine month-long university research program in environmental sciences where high school students from underserved backgrounds conducted research projects under graduate student mentors.
- *Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges*—Since last year, we have developed relationships with five new community colleges (a 71% increase from last year) in an effort to introduce community college students to science and engineering projects and university experiences. These five community colleges are: Cabrillo College, Citrus College, Los Angeles City College, Mt. San Antonio College, and Napa Valley College. We will be developing relationships with more community colleges this year through our

upcoming program involving the California statewide MESA office, MESA Engineering programs and MESA Community College programs (MESA is a program for educationally disadvantaged students).

- *Aeronautics research – research in traditional aeronautics disciplines; research in areas that are appropriate to NASA's unique capabilities; directly address the fundamental research needs of the Next Generation Air Transportation System (NextGen)*—The CaSGC has conducted aeronautics research in the following projects: High Endurance Green Aircraft Design using advances in solar cell efficiency, aircraft design, and lightweight composite materials to develop a solar-powered UAV that has a near infinite endurance and range. The UAV is being designed at UC San Diego (our CaSGC lead institution) and will be flight-tested at NASA Dryden. Another aerospace research project we are conducting is the Control of Mixing in High-Speed Combustors at our San Diego State University affiliate.
- *Environmental Science and Global Climate Change – research and activities to better understand Earth's environments*—The CaSGC is conducting this research at our UC Davis affiliate in the Hyperspectral Infrared Imager study of the world's ecosystems, providing critical information on the state of the world's ecosystems, including vegetation, pre-eruptive behavior of volcanoes, and gases released from wildfires.
- *Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research toward NASA priorities*—This year's CaSGC Research Infrastructure projects have been focused on graduate students and we are considering adding a program aimed at early career faculty.

IMPROVEMENTS MADE IN THE PAST YEAR

In the previous fiscal year, there was a transition to a new Director. This fiscal year, FY2012, we created an Assistant Director position in addition to the Program Coordinator position (this was reflected in the budget submitted to NASA in June 2012). This staffing increases the capacity of our CaSGC program office to conceive, design, and implement programs that better align with NASA's priorities. This past year we have increased the number of Minority Serving Institutions participating in our programs by partnering community colleges with our four-year university affiliates to give community college students laboratory research experience and to bridge them to studying STEM at a four-year institution. In addition to this, CaSGC program staff have initiated brand new hands-on student-mentor projects at MSI community colleges, investing time getting the projects underway and forming cohesive teams. We have been listening very carefully to the needs of the NASA Office of Education and are working diligently to modify and create new programs to address these needs.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

CONSORTIUM AFFILIATES (28):

- Astronomical Society of the Pacific: A formal and informal education provider conducting several precollege programs for the consortium with professional development for in-service and pre-service teachers.
- Azusa Pacific University: Four-year, private, not-for-profit university offering Bachelor's, Master's, and Doctoral degrees. Executing higher education and fellowship/scholarship programs for the consortium.
- California State Polytechnic University – Pomona: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Minority Serving Institution carrying out several higher education programs for the consortium.
- California State Polytechnic University – San Luis Obispo: Four-year, public institution offering Bachelor's and Master's degrees.
- California Institute of Technology: Four-year, private, not-for-profit university offering Bachelor's, Master's, and Doctoral degrees. The relationship with this affiliate is in transition; we have identified candidates for a new CaSGC campus director and will soon resume CaSGC programs on that campus. Throughout this transition, however, we have continued to support Caltech students at NASA centers.
- CSU Sacramento: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Conducting CaSGC higher education workforce development projects in conjunction with NASA Johnson Space Center.
- CSU San Bernardino: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Minority Serving Institution performing CaSGC higher education workforce development projects in conjunction with NASA Dryden Flight Research Center.
- CSU Long Beach: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Minority Serving Institution implementing CaSGC precollege programs for in-service teachers and middle school students as well as higher education workforce development rocket projects. Affiliate serves on a CaSGC advisory board.
- CSU Los Angeles: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Minority Serving Institution performing Unmanned Aerial Vehicle projects with NASA Dryden Flight Research Center.
- Fresno State: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Minority Serving Institution executing CaSGC precollege program for high school students as well as higher education workforce development Unmanned Aerial Vehicle projects. Affiliate serves on a CaSGC advisory board.
- Pomona College: Four-year, private, not-for-profit university offering Bachelor's degrees. Hosted the CaSGC southern California meeting.
- San Diego Community College District: A district of three community college campuses and one continuing education campus. The three community colleges offer certificates and Associates degrees. Within this district, San Diego City College, a Minority Serving Institution, has run, in conjunction with San Diego State University

and Southwestern College, the CaSGC MESA Research Academy for community college students to experience hands-on research in a university laboratory.

- San Diego State University: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Minority Serving Institution executing, with San Diego City College and Southwestern College, the CaSGC MESA Research Academy for community college students to experience hands-on research in a university laboratory. This affiliate also has a "mentoring chain" for aerospace research where graduate students being mentored by professors lead research teams of undergraduates, who in turn mentor community college students and perform outreach to precollege students as part of the MESA program.
- San Diego Supercomputer Center: An institution leading in cyberinfrastructure innovation, development, and expertise. The CaSGC works with this institution's Education Group, which conducts "TeacherTECH" in-service professional development in Space Sciences for our consortium. This affiliate also serves on a CaSGC advisory board.
- San Jose State University: Four year, public institution offering Bachelor's and Master's degrees. Has carried out several CaSGC programs at NASA Ames Research Center.
- Santa Clara University: Four-year, private, not-for-profit university offering Bachelor's, Master's, and Doctoral degrees. Provides several higher education workforce development programs for students in robotics, CubeSats, and satellite operations in conjunction with NASA Ames Research Center.
- Sonoma State University: Four year, public institution offering Bachelor's and Master's degrees. Has provided laboratory research experiences for undergraduates and high school students. This affiliate serves on a CaSGC advisory board.
- Stanford: Four-year, private, not-for-profit university offering Bachelor's, Master's, and Doctoral degrees. The relationship with this affiliate is in a state of transition; we have identified candidates for a new CaSGC campus director and will soon resume CaSGC programs on that campus. Throughout this transition, however, we have continued to support Stanford students in NASA internships.
- UC Berkeley: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Conducts Fellowship/Scholarship programs in Space Sciences.
- UC Davis: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Carries out Fellowship/Scholarship, Research Infrastructure, Higher Education, and Precollege programs for the CaSGC in Environmental Sciences. Affiliate serves on a CaSGC advisory board.
- UC Irvine: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Executes graduate Fellowship/Scholarship programs in Earth System Science.
- UC Los Angeles: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Provides graduate Fellowship/Scholarship programs in Earth and Space Sciences. Campus director is the Principal Investigator of the NASA Dawn Mission.

- UC Riverside: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Minority Serving Institution providing graduate and undergraduate fellowships/scholarships in Engineering as well as Precollege projects associated with the MESA program.
- UC San Diego: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Serves as Lead Institution for the CaSGC. Provides graduate fellowships in Engineering and multidisciplinary undergraduate scholarships, conducts aerospace research, and runs the Near Space Balloon Team higher education project.
- UC Santa Barbara: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Various projects through the Experimental Cosmology Group providing undergraduate and graduate students with hands-on team experience designing and developing space-related instrumentation.
- UC Santa Cruz: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees. Runs astrophysics programs with Hartnell and Cabrillo Colleges (MSIs) to develop students for careers in STEM research. Affiliate serves on an advisory board for the CaSGC.
- University of San Diego: Four year, public institution offering Bachelor's, Master's, and Doctoral degrees.
- University of Southern California: Four-year, private, not-for-profit university offering Bachelor's, Master's, and Doctoral degrees. Higher Education hands-on team research and development of CubeSats and a Lunar Lander in the Department of Astronautical Engineering.

We are grateful for the participation of our Education, Government, Industry, Informal Education, Society & Organization partners for their participation in our programs:

Education

- Cabrillo College
- California Community College Chancellor's Office
- California MESA Program
- Citrus College
- College of San Mateo
- College of the Desert
- Hartnell College
- Los Angeles City College
- Mt. San Antonio College
- Napa Valley College
- National Center for Earth and Space Science Education
- San Diego MESA Alliance
- Santa Barbara City College
- Sonoma County Office of Education

- Southwestern College
- UCSD Jacobs School of Engineering

Government

- Air Force Office of Scientific Research (AFOSR)
- Department of the Navy
- NASA Ames Research Center
- NASA Dawn Project
- NASA Dryden Flight Research Center
- NASA Glenn Research Center
- NASA HQ - Origins Program
- NASA Jet Propulsion Laboratory
- NASA Langley Research Center
- National Renewable Energy Laboratory
- National Science Foundation

Industry

- Broadcast Microwave Systems
- Flometrics
- Garvey Spacecraft Corporation
- General Atomics
- NanoRacks
- NextGen Aeronautics
- Northrop Grumman
- SpaceX
- The Boeing Company

Informal Education

- Columbia Memorial Space Center
- Reuben H. Fleet Science Center
- San Diego Air & Space Museum
- San Diego Astronomy Association
- San Diego Space Society

Societies & Organizations

- AmericaView
- Association for Unmanned Vehicle Systems International
- Campo Native American Reservation
- IEEE Control Systems Society
- National Council for Science and the Environment
- National Society of Black Engineers
- Packard Foundation
- Society of Hispanic Professional Engineers
- Society of Women Engineers
- The American Institute of Aeronautics and Astronautics

The National Space Grant Office requires two annual reports, this Annual Performance Data Report (APD) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.